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ABSTRACT

The relationship between investment in education and economic growth in Alberta, Canada, is explored in this paper, which examines the value of education to the individual in terms of rate of employment and salary. Assuming earning differentials to be a measure of the contribution of education to economic growth, the lifetime earnings of high school graduates were compared to those of two groups: those with less than grade 9 education and those with some high school education. Findings indicate that completion of high school is profitable, especially for females, and that a direct positive relationship exists between education spending and the gross domestic product (GDP) in Alberta. A conclusion is that educated people earn higher salaries and contribute more to the economy in terms of increased productivity and spending and that there are good reasons why the completion of high school and public investment in education should be encouraged. Seven figures and 15 tables are included. Appendices contain data on male and female average incomes in Alberta, the GDP, and basic education costs. (Contains 24 references.) (LMI)

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Linking Investment in Education To Economic Growth

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ABSTRACT

This paper studies the link between investment in education and economic growth in Alberta, Canada. In so doing, the paper examines the value of education to the individual in terms of rate of employment and salary. Investment in education is measured by student enrolment rates, the number of teachers employed, the amount of funding for education, and expenditures on education. Economic growth is determined using the growth accounting approach developed by Solow (1957), Kendrick (1961) and Denison (1962, 1974). Gross Domestic Product (GDP) is used to measure economic growth.

The study finds a direct positive relationship between education spending and the GDP in Alberta. Between 1961 and 1990, 95% of the variation in the GDP can be explained by spending on education.

Assuming earning differentials to be a measure of the contribution of education to economic growth, the study uses differential lifetime earnings to compare high school graduates to two groups: those having less than grade 9 education and those having some high school education. The study finds that, in Alberta, individuals with less than a grade 9 education can expect to lose an average of $144,775 in lifetime earnings by not completing high school.

The paper concludes that as people become more educated, they earn higher salaries and contribute more to the economy in productivity and spending. There are solid reasons for encouraging individuals to stay in school and for continued public investment in education.

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INTRODUCTION

Education directly affects our individual quality of life and opportunities, as well as our national growth and economic competitiveness (Funk, 1991). Everyone agrees that education is valuable. But, precisely how valuable is it? Does staying in school result in higher incomes and improved employment opportunities? Does overall investment in education contribute to economic growth? Does what we spend on the education of our children make a difference to our economy? Is there a link between what we spend, how long students spend in school and our economic growth?

This paper looks at investment in education and its relationship to economic growth in Alberta. In so doing, the paper examines the value of education to the individual in terms of rate of employment and salary.

I. ALBERTA'S INVESTMENT IN BASIC EDUCATION

There are a number of yardsticks that can be used to measure Alberta's investment in education and the size of the sector in Alberta's economy. These include student enrolment rates, the number of teachers employed, the amount of funding directed towards education, and expenditures.

Enrolment and Employment of Teachers

Table 1 describes the changes in enrolment and employment in elementary and secondary schools in Alberta from 1951 to 1990. Total enrolment increased from 179,691 in 1951 to 486,612 in 1990. The number of teachers has increased from 13,751 in 1951 to 29,172 in 1990. In 1951, teachers represented 3.9% of total employment compared to 2.4% in 1990.

Table 1

Size of Elementary and Secondary School Sector

Year	Number of Students	Percent of Population	Number of Teachers	Percent of Employment
1951	179,691	19.1	13,751	3.9
1961	307,702	23.1	13,342	2.8
1971	425,468	26.1	22,255	3.5
1981	442,900	19.8	25,016	2.2
1990	486,612	19.7	29,172	2.4

Sources: Alberta Education; Alberta Bureau of Statistics; and Statistics Canada, Catalogue 71-529

Funding of Education in Alberta

The funding of education in Alberta is a cooperative joint undertaking of locally elected school boards and the provincial government. School boards are responsible for a portion of education costs through taxation on both residential and non-residential property, while the province provides a major portion of funds from general revenues and a tax levy on non-residential property. In the 1991-92 school year, for example, jurisdictions are estimated to receive approximately 59 percent of their revenues from the provincial government, 35 percent from local property taxes, and 5 percent from miscellaneous fees and charges.

Table 2 describes total expenditures in education in Alberta from 1980 to 1990 and the proportionate share of the funding from provincial and local sources. In 1980 total operating costs were $1,069,481,086. By 1990 costs had risen to $2,496,893,256. In 1980 the province contributed $740,720,226 or 69% of revenues compared to $336,020,960 or 31% from local sources. By 1990, while the provincial contribution had increased to $1,481,818,428, this represented only a 60% share of the revenues. By comparison, the local contribution had increased to $1,013,466,717 or 41% of total revenues.

Table 2

Share of Elementary and Secondary Education Financed by Each Level

Year	Provincial Contribution ($)	Provincial Contribution (%)	Local Contribution ($)	Local Contribution (%)	Total Expenditures
1980	740,720,226	68.79	336,020,960	31.21	1,069,481,086
1982	1,039,672,736	65.31	552,225,026	34.69	1,596,244,165
1984	1,159,652,997	63.93	654,288,649	36.07	1,811,575,092
1985	1,222,357,114	64.04	686,370,965	35.96	1,914,062,836
1986/87	1,287,453,351	62.92	758,882,787	37.08	2,041,395,049
1987/88	1,251,753,044	60.67	811,362,704	39.33	2,057,498,018
1988/89	1,317,813,021	60.42	863,272,556	39.58	2,183,620,187
1989/90	1,429,216,948	59.95	954,626,081	40.05	2,384,232,051
1990/91 (E)	1,481,818,428	59.38	1,013,466,717	40.62	2,496,893,256

Source: Alberta Education
(E) Estimates

Expenditures

Table 3 tabulates the changes in educational expenditures from 1980 to 1990 in current and constant dollars. The annual expenditures are displayed also as a percent of the Gross Domestic Product (GDP) and in relation to the Consumer Price Index (CPI).

Total expenditures on elementary and secondary education increased from $1.1 billion in 1980 to $2.5 billion in 1990. Expenditures increased from $1.5 billion to $2.1 billion in constant dollars (1986 = 100), and after 1980, the trend in expenditures was fairly level, fluctuating by approximately $180 million during the decade. In current dollars, the trend in expenditures shows a steady increase. The dip in both current and constant dollar expenditures between 1986 and 1988 was due to the provincial government's 3% reduction of grant rates in 1986-87.

Educational expenditures as a percent of the GDP show little variation. The lowest is 3.0% in 1980.

Table 3

Changes in Educational Expenditures, Gross Domestic Product and Consumer Price Index 1980 - 1990

Year	Current Expenditure ($)	Constant Expenditure (1986 = 100) ($)	Percent of GDP	CPI (1986 = 100)	Percent Change
1980	1,069,481,086	1,543,262,750	3.00	.693	10.17
1981	1,310,971,552	1,682,890,311	3.06	.779	12.41
1982	1,596,244,165	1,847,504,821	3.53	.864	10.91
1983	1,714,549,292	1,877,929,126	3.70	.913	5.67
1984	1,811,575,092	1,931,316,729	3.58	.938	2.74
1985	1,914,062,836	1,977,337,640	3.52	.968	3.20
1986/87	2,041,395,049	2,041,395,049	3.61	1.000	3.31
1987/88	2,057,498,018	1,974,566,236	3.43	1.042	4.20
1988/89	2,183,620,187	2,040,766,530	3.27	1.070	2.69
1989/90	2,384,232,051	2,132,586,808	3.38	1.118	4.49
1990/91 (E)	2,496,893,256	2,119,603,783	3.34	1.178	5.37

Source: Alberta Education (E) Estimates

Educational expenditures have tended to increase more rapidly than the CPI. The exception is the period 1986 to 1988 when educational expenditures decreased but costs continued to grow. The CPI increased by 3.0% during the two years following 1986, but educational expenditures decreased by $34 million.

Table 4 presents student enrolments in Alberta schools from 1980 to 1990 and the expenditures per student in current and constant dollars. In current dollars, expenditures per student increased from $2,512 per student in 1980 to $5,336 per student in 1990. Of course, price levels increased substantially in the same period (Table 3), so that dollars of expenditures in 1980 cannot be compared to dollars of expenditures in 1990. Using the implicit price deflator for the CPI, per student expenditures in 1986 dollars increased from $3,625 in 1980 to $4,529 in 1990, an increase of 24.9%. Investment in education has increased in both current and constant dollars.

Table 4

Per Student Expenditures

Year	Current Expenditure ($)	Total Enrolments	Per Student Expenditures (Current $)	Per Student Expenditures (In 1986 $)
1980	1,069,481,086	425,774	2,512	3,625
1981	1,310,971,552	429,534	3,052	3,918
1982	1,596,244,165	434,828	3,671	4,249
1983	1,714,549,292	434,626	3,945	4,321
1984	1,811,575,092	432,610	4,188	4,464
1985	1,914,062,836	434,226	4,408	4,554
1986/87	2,041,395,049	437,092	4,670	4,670
1987/88	2,057,498,018	438,244	4,695	4,506
1988/89	2,183,620,187	445,930	4,901	4,581
1989/90	2,384,232,051	455,510	5,234	4,682
1990/91 (E)	2,496,893,256	467,970	5,336	4,529

Source: Alberta Education
(E) Estimates

II. EDUCATION AND ECONOMIC GROWTH

In his study of economic growth in the United States, Denison (1962) defined economic growth as the increase in the national product measured in constant dollars. A number of studies have applied Denison's original model to other countries. Correa (1970) calculated the contribution of education to economic growth for eight northwest European countries and nine Latin American countries. Estimates of the contribution of education to economic growth for other countries during the 1950s and 1960s have been reported by Psacharopoulos (1984). The results show a high contribution of education to growth in Canada, three African countries, and South Korea.

Table 5

Contribution of Education as a % of National Income Growth in Selected Countries

Country	Contribution to Growth
Africa	
Ghana	23.2
Kenya	12.4
Nigeria	16.0
Asia	
Israel	4.7
Japan	3.3
Malaysia	14.7
Philippines	10.5
South Korea	15.9
Europe	
Greece	3.0
U.S.S.R.	6.7
North America	
Canada	25.0

Source = Psacharopoulos (1984)

The Growth Accounting Approach

Pioneered by Solow (1957), Kendrick (1961) and Denison (1962, 1974), the growth accounting approach views the economy as a production function in which a set of inputs is combined to produce output, i.e., national income or product. Traditionally, economists have identified three factors of production: land, labour, and capital.

$$Y = f[I, L(E,N)]$$

I = Non-labour inputs
L = Labour
E = Amount of education
N = Number of workers

Changes in output depend upon changes in the inputs, (I), changes in L, or upon changes in the production function itself, f. Changes in the effective stock of labour depend upon changes either in the amount of education or in the other components of the stock of labour. Enhancing the stock of labour, including increased education, is seen as one important way of adding to growth.

Using a growth accounting method, Bertram (1966) assessed the contribution of education to Canada's economic growth from 1911 to 1961, and found that education contributed about 12% to Canadian growth. Total output per employed worker rose at an average annual rate of 1.67% per year. He also found that improved labour quality due to formal education raised productivity by 0.52% per year on average. When combined with labour's 76% share in national income, education raised total factor productivity by 0.40% per year, and thus accounts for fully one quarter of the average increase in productivity growth.

Education's Contribution to Alberta's Growth

The linkage between education and the GDP is complex. There are many factors influencing a nation's earnings and production, such as stock in physical capital, human capital, or labour, and technological progress. In addition, individual earning power is influenced not only by higher stock of human capital but also by social and environmental factors. As a result, trying to estimate the statistical relationship between education spending and the level of the GDP might produce erroneous results. When attempting to control factors such as physical capital and labour, perverse effects can be anticipated because these two factors are highly correlated.

The use of multivariate analysis to determine the effect of education on the GDP is beset both by identification problems and by the high correlation among the values of many of the independent variables influencing the GDP. While we may be fairly certain that education is a factor influencing the GDP, it is desirable to know how some interrelating factors cause differences in the GDP.

A regression analysis was performed to demonstrate the relationship between the level of gross domestic product (dependent variable) and education spending (independent variable). An increase in education spending will result in an increase in the level of gross domestic product, as people will earn and spend more.

The above relationship is expressed by the following regression equation (details appear in Appendix 5):

$$Y = a + b \quad \text{where}$$

$$\text{GDPA86} = a + b\text{BCOST}$$

Y = GDPA86 (dependent variable) - gross domestic product in millions of dollars

a = Y - intercept determines the value of Y when X = 0

b = "slope" of the line representing how much each unit change of the independent variable X changes the dependent variable

X = BCOST (independent variable) - basic education costs in thousands of dollars

Using estimates in the above equation yields the following results:

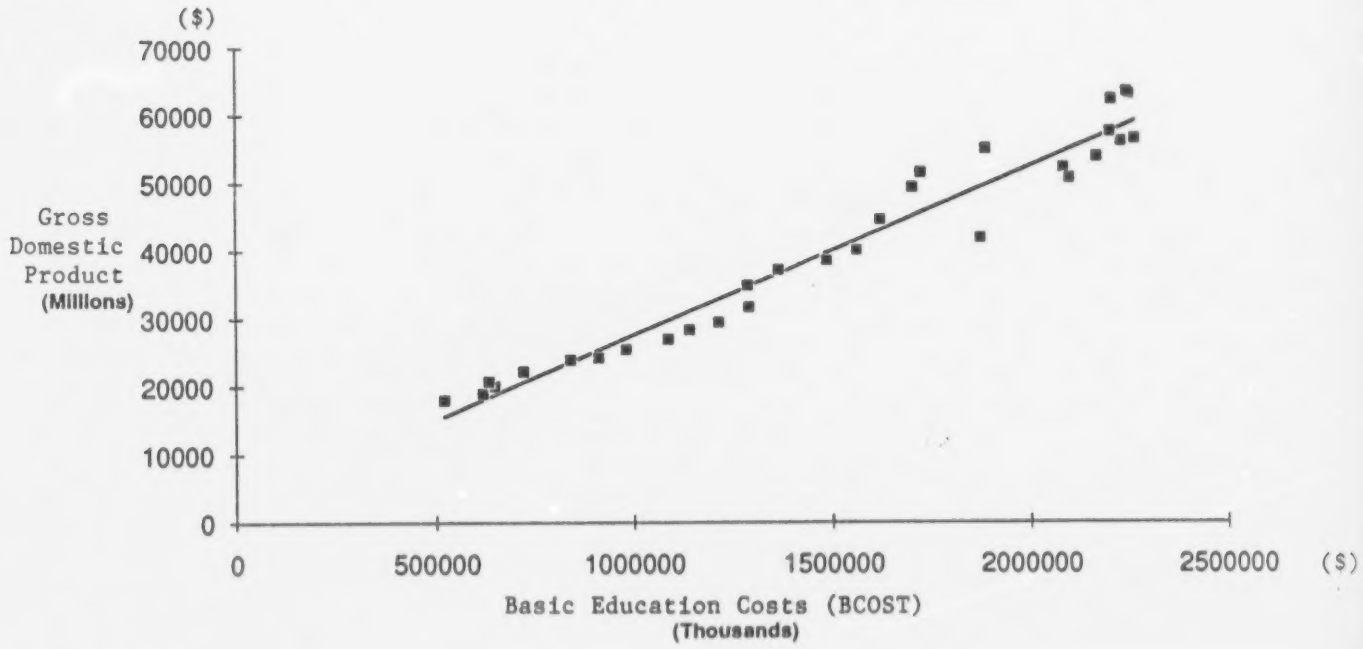
$$\text{GDPA86} = \underset{(1.54)}{2{,}562.46} + \underset{(24.10)}{2.5\text{E} - 02}\ \text{BCOST}$$

The results show a very strong correlation between education spending and gross domestic product. R^2, the coefficient of determination, provides a measure of the accuracy of prediction. The regression produced an R^2 of 0.95 which indicates that 95% of the variation in the GDP can be explained by spending in education.

Data showing the relation between basic education costs and the GDP with a regression line drawn through the data points is presented in the scatter diagram, Figure 1. The regression line defines a precise, one-to-one relation between each X value (basic education costs) and its corresponding Y value (GDP). When X increases, Y also increases, indicating a positive correlation between the two variables.

Figure 1

Relationship Between Gross Domestic Product and Education Spending 1961 - 1990



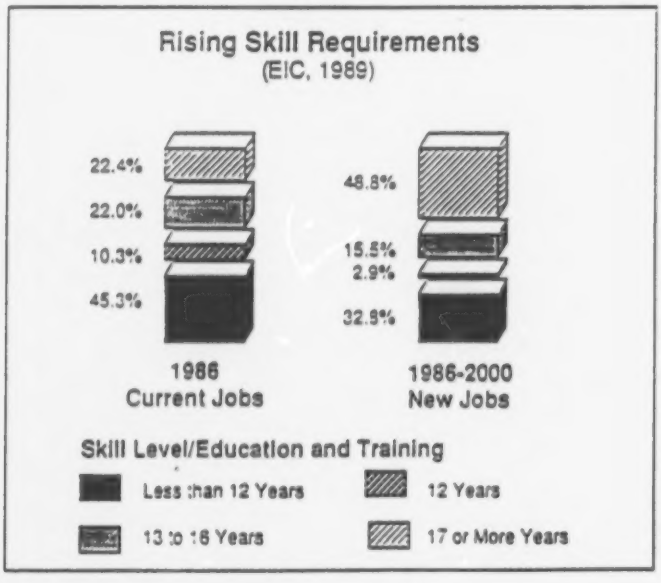
III. ECONOMIC RETURNS OF EDUCATION TO THE INDIVIDUAL

Increasingly in today's labour market, employers are demanding higher qualifications. People must have higher levels of education to get and keep jobs. There are other advantages to encouraging students to stay in school. People with higher levels of education earn higher salaries and tend to have greater flexibility in their career choices. Higher levels of education produce future benefits for both individuals and society. Despite these realities, Employment and Immigration Canada estimates that 100,000 Canadian high school students drop out of school every year. This translates to one dropout for every 45 seconds of the school day. The cost to Canada is estimated to be $33 billion over the next 20 years. At the same time, errors and lost productivity cost Canadians approximately $4 billion a year.

Rising Skill Requirements

Fifteen years ago in Canada, manufacturing industries hired people with 9 or 10 years of schooling. Today, most are asking for high school graduates. This trend applies to all sectors. By 1986, 22.4% of all jobs required 17 or more years of education and training, and 45.3% required fewer than 12 years (Figure 2). In its publication, ***A National Stay-In-School Initiative (1990)***, Employment and Immigration Canada estimated that individuals in Canada who do not complete high school will be ineligible for over 60% of all new jobs created. During the 1990s, 32.8% of all new jobs are expected to require more than 12 years of education and training; 48.8% will demand more than 17 years (Figure 2).

Figure 2

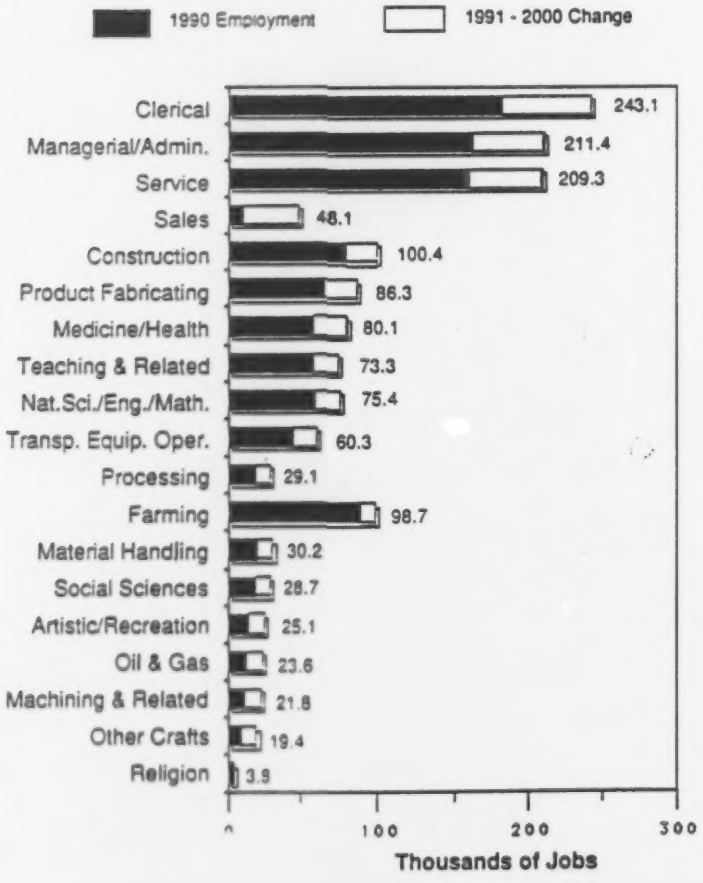


Source: Success in the Works: A Policy Paper,
Employment and Immigration Canada, April 1989

A study by Alberta Career and Development and Employment, ***The Labour market of the '90s: Employment and Occupational Trends***, analysed the employment growth rate from 1990 to the year 2000 in Alberta and listed some significant shifts in the job requirements for the future. It concluded that 62% of all new jobs will require some form of post-secondary education. Figure 3 lists the occupational trends for 1990 with the anticipated additional jobs to the year 2000, and Figure 4 shows the number of jobs available to Albertans with different levels of education.

Figure 3

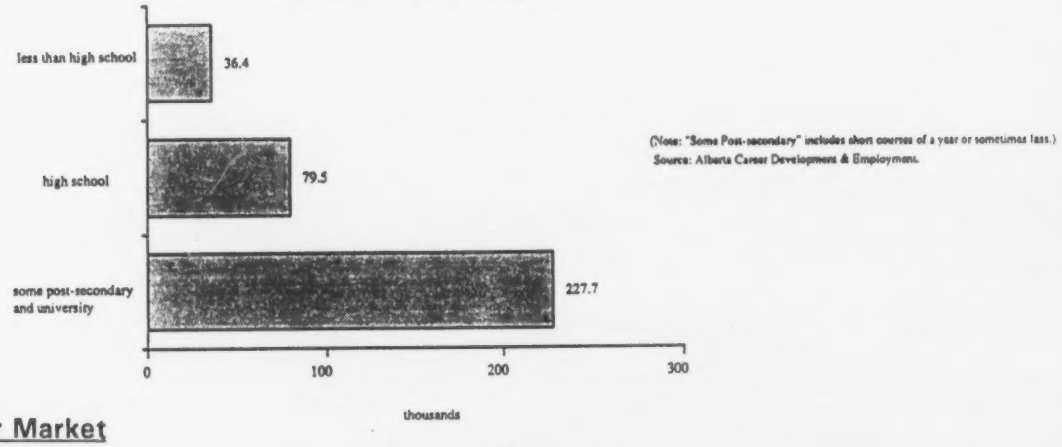
Employment Growth by Occupational Group
Alberta, 1990 - 2000



Source: The Labour Market of the '90s:
Employment and Occupational Trends,
Alberta Career Development and Employment

Figure 4

Projected Job Availability by Education Level
Alberta, 1990 - 2000



The Labour Market

Level of education is directly linked to employability as can be seen through an examination of labour force participation rates. Table 6 presents Alberta's labour force participation rates from 1966 to 1990 for males and females, as well as total participation rates. In 1966, 82.8% of males and only 40.3% of females participated in the labour force. The combined participation rate was 61.7%. Male labour force participation peaked in 1981 at 85.2%, but leveled off at about 81% through to 1990. Female participation rates increased to about 63% in 1987, but have levelled off since then. Total labour force participation rates increased to 72.3% in 1981 and remained at approximately that level through to 1990.

Table 6

Alberta Labour Force Participation Rates[1]

Year	Male	Female	Total
1966	82.81	40.28	61.65
1971	80.82	45.10	63.09
1976	82.95	50.70	66.95
1981	85.17	58.97	72.30
1986	81.88	62.46	72.16
1987	81.16	62.83	71.96
1988	81.08	63.86	72.42
1989	81.02	63.85	72.37
1990	80.62	63.76	72.13

Source: Statistics Canada, Catalogue 71-529
Statistics Canada, Catalogue 71-220

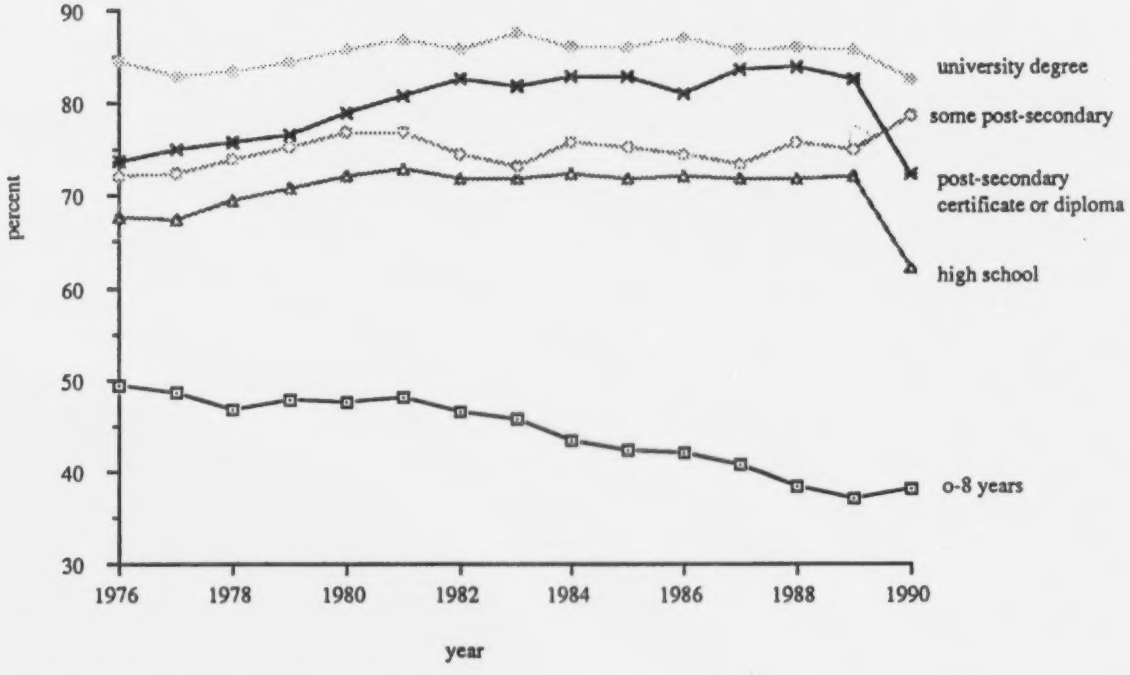
[1]The labour force is defined as those people 15 years or older who were working or available for work during a given period. The participation rate refers to the ratio of the labour force to the total population 15 years or older.

Figure 5 and Table 7 illustrate the labour force participation rates by level of education. In 1976, the rate was 49.3% for those with 8 or fewer years of schooling. By 1990 the participation rate for this group had declined to 38%. For those with high school education, the participation rate in 1976 was 67.7%. By 1989 this had increased to 72.3%, but dropped to 62% in 1990. The participation rate for persons with some post-secondary education increased from 72.3% in 1976 to 78.6% in 1990. Participation rates for persons with post secondary certificates increased from 73.8% in 1976 to 82.6% in 1989, but dropped to 72.5% in 1990. Labour force participation rates for persons with university degrees increased from 84.4% in 1976 to 86% in 1988, but declined to 82.7% in 1990.

Overall, labour participation rates have increased since 1966, especially for females and for persons with a high school or higher level of education. The recession in 1990 appears to have affected most groups; however, persons with less than a high school education have fared the worst. Labour force participation rates for the group with 8 or fewer years of schooling have declined steadily.

Figure 5

Labour Force Participation Rates by Levels of Schooling
Alberta, 1976 to 1990



Source: Statistics Canada, Catalogue 71-529.

Table 7

Labour Force Participation Rates (%) by Years of Schooling - Alberta

Years	0 - 8 Years	High School	Some Post Secondary	Post Secondary Certificate	University Degree
1976	49.3	67.7	72.3	73.8	84.4
1977	48.5	67.5	72.4	75.1	82.8
1978	46.7	69.5	73.9	75.9	83.5
1979	47.9	71.0	75.2	76.7	84.5
1980	47.5	72.1	76.8	78.9	85.7
1981	48.0	73.1	76.9	80.8	86.9
1982	46.4	71.8	74.6	82.7	85.8
1983	45.8	71.8	73.3	81.9	87.6
1984	43.3	72.4	75.9	82.9	86.1
1985	42.4	71.9	75.4	82.8	86.1
1986	42.1	72.2	74.6	81.2	87.1
1987	40.6	71.9	73.6	83.6	85.9
1988	38.3	72.0	75.8	84.0	86.0
1989	37.0	72.3	75.1	82.6	85.7
1990	38.0	62.1	78.6	72.5	82.7

Source: Statistics Canada, Catalogue 71-529

In Alberta, youth (persons aged 15 to 24, Table 8) unemployment is consistently 4 to 5 percent higher than the provincial rate, and particularly high among the 15 to 19 age group. The unemployment rate for this group increased from 8.7% in 1980 to 12.5% in 1990. Similarly, the rate for 20 to 24 year olds was 9.7% in 1990, having increased from 5.4% in 1980.

As one's level of education increases, so does the probability of being employed. Statistics Canada's labour force data for 1990 indicates that, in Alberta, the unemployment rate in 1990 was 3.5% for university graduates in all age groups (Table 9). For Albertans with a post-secondary certificate or diploma from institutions other than universities, the unemployment rate was 5.3%. For high school graduates, the unemployment rate was 6.7%. The unemployment rate in Alberta for people with no more than a grade 8 education was 10.7%.

Unemployment rates for persons with a high school or higher level of education have generally declined since 1982 (Figure 6, Table 10). Unemployment rates for persons with 0 - 8 years of schooling tend to be uniformly high, staying at over 12% until 1989 when the rate declined to about 10%. However, the rate for both these groups went up one percentage point in 1990.

One explanation for these rates is that many in this group are new entrants to the labour force. During economic downturns, youths have a higher rate of unemployment because of hiring freezes and their lack of experience and seniority (Statistics Canada, 1990).

However, the proportion of employed youth working part-time increased from 21.1% to 30.6% between 1982 and 1990 (Table 11). This growth is in contrast to the small increase in the proportion of part-time work among adults, from 10.3% to 11.3%. Some of the increase can be explained by the progressive shift of youth employment to the service-producing sector where part-time employment has grown through the decade.

Table 8

Alberta Unemployment Rates by Age
1977 - 1990

YEAR	YEARS OF AGE BY PERCENTAGE				PROVINCIAL RATE
	15 - 19	20 - 24	25 - 44	45 - 64	
1977	11.2	6.0	3.1	2.5	4.5
1978	10.8	6.3	3.8	2.4	4.7
1978	8.9	4.7	3.1	2.2	3.9
1980	8.7	5.4	2.7	1.9	3.7
1981	9.1	5.2	2.9	2.1	3.8
1982	15.4	11.1	6.7	3.8	7.7
1983	19.1	15.0	9.5	6.8	10.6
1984	17.8	15.4	10.4	7.5	11.1
1985	19.6	12.8	8.9	7.6	10.0
1986	17.9	13.2	8.7	7.7	9.8
1987	17.2	14.1	8.1	8.2	9.6
1988	13.6	11.7	7.0	6.7	8.0
1989	13.4	9.0	6.7	5.6	7.2
1990	12.5	9.7	6.6	5.3	7.0

SOURCE: Statistics Canada, Catalogue 71-529, Catalogue 71-220
Labour Force Annual Averages.

Table 9

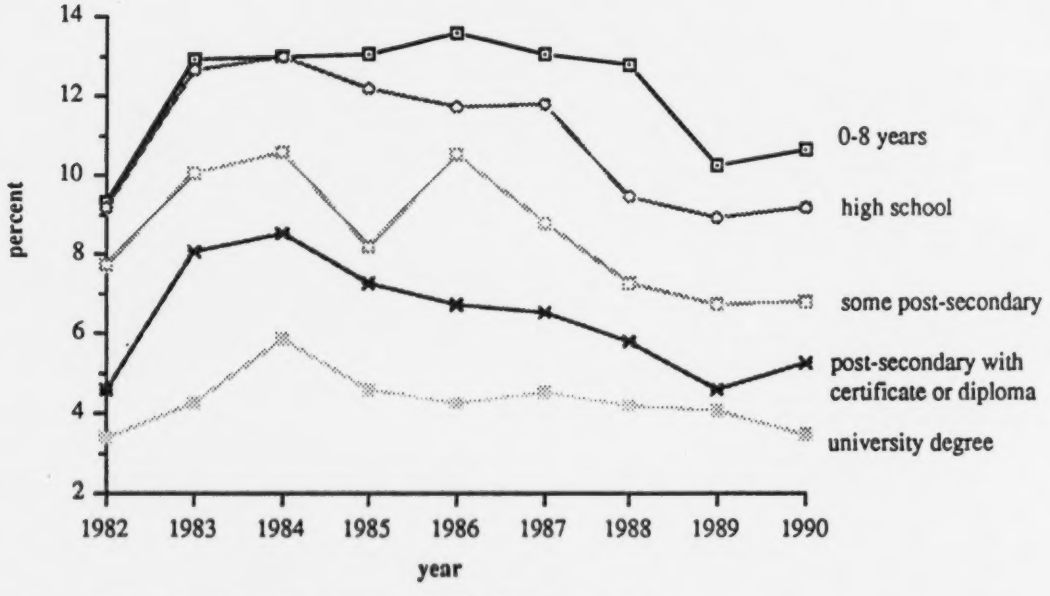
1990 Unemployment Rates by Level of Schooling
Comparing Alberta to Canada

EDUCATIONAL ATTAINMENT	ALBERTA (%)	CANADA (%)
Total	7.0	8.1
0 - 8 Years	10.7	12.5
Some Secondary	11.5	12.2
High School	6.7	7.7
Some Post-Secondary	6.8	8.0
Post-secondary Certificate of Diploma	5.3	6.3
University Degree	3.5	3.7

SOURCE: Statistics Canada, Catalogue 71-529, Catalogue 71-220 Labour Force Annual Averages.

Figure 6

Unemployment Rates by Level of Schooling,
Alberta, 1982 to 1990



Sources: Statistics Canada, Catalogue 71-529: Catalogue 71-220.

Table 10

Unemployment Rates by Level of Schooling, Alberta
1982 - 1989

Years	Alberta (%)	0 - 8 Years (%)	High School (%)	Some Post Secondary (%)	Post Secondary Certificate or Diploma (%)	University Degree (%)
1982	7.7	9.3	9.2	7.7	4.6	3.4
1983	10.6	12.9	12.7	10.1	8.1	4.3
1984	11.1	13.0	13.0	10.6	8.5	5.9
1985	10.0	13.1	12.2	8.2	7.3	4.6
1986	9.8	13.6	11.7	10.5	6.7	4.3
1987	9.6	13.1	11.8	8.8	6.5	4.5
1988	8.0	12.8	9.5	7.3	5.8	4.2
1989	7.2	10.3	8.9	6.7	4.6	4.1

Source: Statistics Canada, Catalogue 71-529, Catalogue 71-220
Labour Force Annual Averages

Table 11

People Employed Part-time (In Thousands), Alberta
1982 - 1990

	1982	1984	1986	1988	1990
PART-TIME EMPLOYMENT					
15 - 24 years	63	67	69	73	71
25 years and over	85	101	104	111	113
Total 15 years and over	148	167	173	184	185
TOTAL EMPLOYMENT					
15 - 24 years	299	253	243	237	232
25 years and over	828	850	899	949	999
Total 15 years and over	1,127	1,104	1,142	1,187	1,231

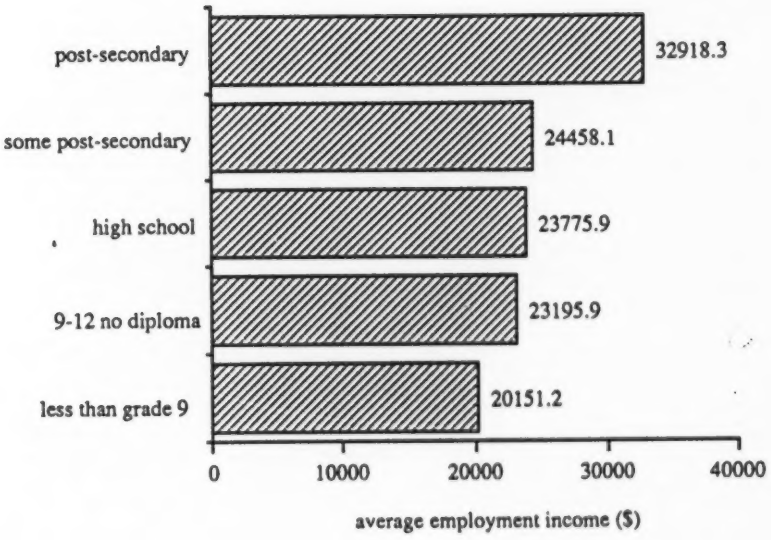
Source: Statistics Canada, Catalogue 71-529, Catalogue 71-220
Labour Force Annual Averages

Income

Employment income[2] is also affected by level of education. According to Canadian Census data (Figure 7, Table 12), in Alberta in 1986 the average income for a person with a post-secondary diploma or degree was $32,918.30. The average income of a high school graduate was $23,775.90 and of a person with less than grade 9 was $20,151.20.

Figure 7

Average Employment Income by Levels of Schooling
Alberta, 1986



Source: 1986 Census of Canada.

[2]Average employment income refers to the weighted mean total employment income of individuals 15 years of age and over who reported employment income. It is calculated by dividing the aggregate employment income of a specified group (eg: males, 45 - 54 years of age) by the number of individuals with employment in that group.

Table 12

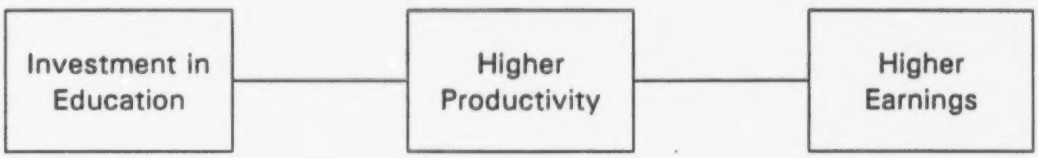
Average Employment Income ($) by Age Groups in Alberta
(1986 Census)

AGE GROUP	LESS THAN GRADE 9	GRADE 9 - 13 WITHOUT DILPOMA	SECONDARY SCHOOL	SOME POST-SECONDARY	POST-SECONDARY	TOTAL
15 - 19	13,102.6	11,057.1	11,473.5	12,770.0	14,409.3	11,678.9
20 - 24	15,511.4	17,110.1	17,156.3	16,574.9	19,102.6	17,780.0
25 - 29	20,541.8	22,272.4	22,797.7	22,536.6	27,118.9	24,985.9
30 - 34	20,063.4	24,075.5	24,507.7	25,269.2	32,302.3	29,231.4
35 - 39	21,922.4	24,758.7	26,725.7	27,368.9	35,818.7	32,080.2
40 - 44	22,501.7	25,582.6	28,663.3	28,151.8	37,396.5	32,764.7
45 - 49	22,579.3	25,595.7	30,837.8	27,779.0	37,929.5	32,153.9
50 - 54	21,058.7	26,563.7	29,133.9	27,697.7	38,801.0	31,553.6
55 - 59	21,038.9	24,597.7	33,013.3	31,618.3	37,477.6	30,324.5
60 - 64	17,924.7	22,113.9	25,969.9	25,066.4	37,535.1	27,403.1
65+	12,257.9	14,482.3	23,267.0	14,913.5	30,725.5	19,059.6
TOTAL	20,151.2	23,195.9	23,775.9	24,458.1	32,918.3	28,308.1

Future Benefits

Economists such as Theodore Schultz (1961, 1971) and Gary Becker (1975) have developed and analyzed the concept of human capital, treating education and training as a form of investment which produces future benefits such as higher income for individuals and higher productivity for society as a whole. A simple description of the process is illustrated below where A - (investment in human capital) leads to B - (higher productivity of workers) which in turn causes C - (higher earnings).

The Human Capital Approach



The concept of human capital asserts that it is possible to measure the profitability (rate of return) of investment in human capital. Returns to education have been calculated for many countries, and have been summarized by Psacharopoulos (1981). His findings are:

(a) returns to primary school are higher than those to other levels of education;

(b) private returns exceed social returns, particularly at the university level;

(c) all rates of return to investment in education are well above 10% (a commonly accepted estimate of the opportunity cost of capital); and

(d) returns to education in less developed countries are higher relative to the corresponding returns in more advanced countries (Table 13).

Table 13

Social Returns to Investment in Education

Country Group	Primary (%)	Secondary (%)	Higher (%)
Developing	27	16	13
Intermediate	16	14	10
Advanced	N/A	10	9

Source: Psacharopoulos 1981

Alberta Study

Building on the human capital approach, this study used earnings differentials to measure the impact of investment in education on economic growth and individual earning power.

To evaluate the profitability of a high school diploma, differential lifetime earnings were used to compare high school graduates to two groups: those having less than grade 9 education and those having some high school education. Alberta data was used throughout.

Measuring the Economic Value of High School Education

Two sets of equations were used for this study. They were the "Net Present Value" (NPV) and "Internal Rate of Return" (IRR).

1. Net Present Value (NPV) is the sum of benefits minus the sum of costs, both discounted by an appropriate rate. It thus represents the net value today of payments in the future, and may be expressed as:

$$NPV = \sum_{t=1}^{n} (B_t/(1+r)^t) - \sum_{t=1}^{n} (C_t/(1+r)^t)$$

Where: n = number of years from the beginning of high school to the age of retirement

B_t = average income of those with a high school diploma in the $_t$ th year

C_t = cost of a high school diploma in the $_t$ th year

r = selected rate of discount

NPV shows the absolute gain or loss due to investment in a high school diploma, and therefore, its value must exceed 0 before investment in education becomes profitable.

2. Internal Rate of Return (IRR) is the discount rate which will equate the total benefits and costs. To estimate the rate of return, the following equation is solved for r:

$$IRR = \sum_{t=1}^{n} \left(\frac{B_t}{(1+r)^t} - \frac{C_t}{(1+r)^t} \right) = 0$$

Unlike the NPV, the internal rate of return does not rely upon a specified discount rate. Instead, the IRR determines the discount rate at which the project will neither benefit nor cost an individual or society. For education to be successful, it must have a return greater than 0.

The study used employment income data from the 1986 Census of Canada to estimate the financial return on three levels of education: high school completion, some high school, and less than grade 9.

The benefit of high school education is measured by the average lifetime employment income of individuals who possess a high school diploma. The cost of high school education is represented by the per student expenditure (direct cost) and opportunity cost (i.e.: the lifetime employment income of persons who have less than high school education). [Note that foregone earnings such as part-time employment earnings of high school students attending school were not included because they are difficult to quantify.]

The 6% rate of discount was chosen based on Alberta's average inflation index. The working life span of an individual is assumed to be ages of 16 to 64. (The provincial law requires students to be in school until age 16.)

Tables 14 and 15 compare the 1986 lifetime employment income of high school graduates to those who have less than grade 9 education and to those who have some high school education.

Findings of Study

It is evident that the lifetime differential income of high school graduates is higher when measured against those who have less than grade 9 education than against those who have some high school. The lifetime differential income of individuals with a high school education versus those who had grade 9 education was estimated to be $303,875 for males and $227,507 for females, compared to $132,418 for males and $59,228 for females with some high school education.

These estimates result in rates of return on a high school education of 6.21% for males and 9.03% for females when compared to those with less than grade 9 education, and 4.43% for males and 3.19% for females when compared to those with some high school education.

The results in this study demonstrate that completion of high school education is more profitable for females. Typically, because of child care obligations, many women experience discontinuity and missed opportunities (seniority, training, etc.) in their working lives. While women with higher levels of education are more likely to return to an appropriate income level, women with less education may never overcome the loss of income capacity due to interruptions in their working life and the subsequent loss of work experience (Woodhall, 1973).

Table 14

Average Lifetime Employment Income of Less Than Grade 9 and High School Education, and Rate of Return of High School Education in Alberta 1986

	Less Than Grade 9 /	High School	Differential Income (Cols. 2 - 1)	Differential Income at 6% Discount Rate	IRR
	Lifetime Income				
	(1) ($)	(2) ($)	($)	($)	(%)
Male	1,110,345	1,414,220	303,875	4,180	6.21
Female	667,745	895,252	227,507	26,314	9.03

Table 15

Average Lifetime Employment Income of Some High School Education, and Rate of Return of High School Education in Alberta, 1986

	Some High School	High School	Differential Income (Cols. 4 - 3)	Differential Income at 6% Discount Rate	IRR
	Lifetime Income				
	(3) ($)	(4) ($)	($)	($)	(%)
Male	1,281,802	1,414,220	132,418	-13,818	4.43
Female	836,024	895,252	59,228	-17,172	3.19

IV. CONCLUSION

When measured over the last ten years, the investment of public funds in education in Alberta has increased in real dollars, and grown faster than the CPI. Between 1961 and 1990, 95% of the variation in the GDP can be explained by spending on education. Spending on education has contributed significantly to Alberta's economic growth.

More and more employers are demanding higher education levels of their employees. Over the next ten years, 62% of all new jobs will require some form of post-secondary education. Well-educated employees are more productive, they earn more, and they contribute more to the economy. There are solid reasons for encouraging individuals to stay in school and for continued public investment in education.

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APPENDIX 1

Male Average Employment Income and IRR With High School Diploma and Less Than Grade 9 in Alberta, 1986

PERIOD	AGE	LESS THAN GRADE 9 (A)	HIGH SCHOOL (B)	DIFF. (B)-(A)	NPV OF DIFF. AT 6% DISCOUNT RATE
1	15	16648	0	-16648	-15719
2	16	16688	0	-16688	-14878
3	17	16688	0	-16688	-14047
4	18	16688	0	-16688	-13263
5	19	12018	12560	542	407
6	20	18059	19110	1051	745
7	21	18059	19110	1051	703
8	22	18059	19110	1051	664
9	23	18059	19110	1051	627
10	24	18059	19110	1051	592
11	25	24009	26142	2133	1134
12	26	24009	26142	2133	1071
13	27	24009	26142	2133	1011
14	28	24009	26142	2133	955
15	29	24009	26142	2133	901
16	30	23126	28331	5205	2077
17	31	23126	28331	5205	1961
18	32	23126	28331	5205	1852
19	33	23126	28331	5205	1748
20	34	23126	28331	5205	1651
21	35	25160	31881	6721	2013
22	36	25160	31881	6721	1900
23	37	25160	31881	6721	1794
24	38	25160	31881	6721	1694
25	39	25160	31881	6721	1600
26	40	25260	34163	8903	2001
27	41	25260	34163	8903	1889
28	42	25260	34163	8903	1784
29	43	25260	34163	8903	1684
30	44	25260	34163	8903	1590
31	45	25618	38555	12937	2182
32	46	25618	38555	12937	2060
33	47	25618	38555	12937	1945
34	48	25618	38555	12937	1836
35	49	25618	38555	12937	1734
36	50	23147	34614	11467	1451
37	51	23147	34614	11467	1370
38	52	23147	34614	11467	1294
39	53	23147	34614	11467	1222
40	54	23147	34614	11467	1153
41	55	22991	38433	15442	1467
42	56	22991	38433	15442	1385
43	57	22991	38433	15442	1307
44	58	22991	38433	15442	1234
45	59	22991	38433	15442	1166
46	60	18953	29103	10150	723
47	61	18953	29103	10150	683
48	62	18953	29103	10150	645
49	63	18953	29103	10150	609
50	64	18953	29103	10150	575
	TOTAL	1110345	1414220	303875	4180

IRR = 0.0621

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APPENDIX 2

Male Average Employment Income and IRR With High School Diploma and Some High School in Alberta, 1986

PERIOD	AGE	9-13 WITHOUT DIPLOMA (A)	HIGH SCHOOL (B)	DIFF. (B)-(A)	NPV OF DIFF. AT 6% DISCOUNT RATE
1	16	16518	0	-16518	-15596
2	17	16518	0	-16518	-14726
3	18	16518	0	-16518	-13904
4	19	11848	12560	712	566
5	20	18732	19110	378	284
6	21	18732	19110	378	268
7	22	18732	19110	378	253
8	23	18732	19110	378	239
9	24	18732	19110	378	225
10	25	24705	26142	1437	309
11	26	24705	26142	1437	764
12	27	24705	26142	1437	721
13	28	24705	26142	1437	681
14	29	24705	26142	1437	643
15	30	27449	28331	882	373
16	31	27449	28331	882	352
17	32	27449	28331	882	332
18	33	27449	28331	882	314
19	34	27449	28331	882	296
20	35	28654	31881	3227	1023
21	36	28654	31881	3227	966
22	37	28654	31881	3227	912
23	38	28654	31881	3227	861
24	39	28654	31881	3227	813
25	40	30391	34163	3772	898
26	41	30391	34163	3772	848
27	42	30391	34163	3772	800
28	43	30391	34163	3772	756
29	44	30391	34163	3772	714
30	45	30537	38555	8018	1432
31	46	30537	38555	8018	1352
32	47	30537	38555	8018	1277
33	48	30537	38555	8018	1205
34	49	30537	38555	8018	1138
35	50	31307	34614	3307	443
36	51	31307	34614	3307	419
37	52	31307	34614	3307	395
38	53	31307	34614	3307	373
39	54	31307	34614	3307	352
40	55	28033	38433	10400	1046
41	56	28033	38433	10400	988
42	57	28033	38433	10400	933
43	58	28033	38433	10400	881
44	59	28033	38433	10400	831
45	60	24272	29103	4831	365
46	61	24272	29103	4831	344
47	62	24272	29103	4831	325
48	63	24272	29103	4831	307
49	64	24272	29103	4831	290
		1281802	1414220	132418	-13818

IRR = 0.0443

APPENDIX 3

Female Average Employment Income and IRR With High School Diploma and Less Than Grade 9 in Alberta, 1986

PERIOD	AGE	LESS THAN GRADE 9 (A)	HIGH SCHOOL (B)	DIFF. (B)-(A)	NPV OF DIFF. AT 6% DISCOUNT RATE
1	15	14014	0	-14014	-13232
2	16	14054	0	-14054	-12529
3	17	14054	0	-14054	-11830
4	18	14054	0	-14054	-11170
5	19	9384	10462	1078	809
6	20	9517	15373	5856	4149
7	21	9517	15373	5856	3918
8	22	9517	15373	5856	3699
9	23	9517	15373	5856	3493
10	24	9517	15373	5856	3298
11	25	11644	19130	7486	3981
12	26	11644	19130	7486	3758
13	27	11644	19130	7486	3549
14	28	11644	19130	7486	3351
15	29	11644	19130	7486	3164
16	30	12858	19513	6655	2656
17	31	12858	19513	6655	2507
18	32	12858	19513	6655	2367
19	33	12858	19513	6655	2235
20	34	12858	19513	6655	2111
21	35	14264	20069	5805	1738
22	36	14264	20069	5805	1641
23	37	14264	20069	5805	1550
24	38	14264	20069	5805	1463
25	39	14264	20069	5805	1382
26	40	14824	20679	5855	1316
27	41	14824	20679	5855	1242
28	42	14824	20679	5855	1173
29	43	14824	20679	5855	1108
30	44	14824	20679	5855	1046
31	45	14841	19901	5060	853
32	46	14841	19901	5060	806
33	47	14841	19901	5060	761
34	48	14841	19901	5060	718
35	49	14841	19901	5060	678
36	50	14533	20579	6046	765
37	51	14533	20579	6046	722
38	52	14533	20579	6046	682
39	53	14533	20579	6046	644
40	54	14533	20579	6046	608
41	55	14127	21194	7067	671
42	56	14127	21194	7067	634
43	57	14127	21194	7067	598
44	58	14127	21194	7067	565
45	59	14127	21194	7067	533
46	60	13829	20520	6691	477
47	61	13829	20520	6691	450
48	62	13829	20520	6691	425
49	63	13829	20520	6691	401
50	64	13829	20520	6691	379
	TOTAL	667745	895252	227507	26314

IRR = 0.0903

APPENDIX 4

Female Average Employment Income and IRR With High School Diploma and Some High School in Alberta, 1986

PERIOD	AGE	9-13 WITHOUT DIPLOMA (A)	HIGH SCHOOL (B)	DIFF. (B)-(A)	NPV OF DIFF. AT 6% DISCOUNT RATE
1	16	14516	0	-14516	-13706
2	17	14516	0	-14516	-12941
3	18	14516	0	-14516	-12219
4	19	9846	10462	616	490
5	20	14500	15373	873	655
6	21	14500	15373	873	619
7	22	14500	15373	873	584
8	23	14500	15373	873	551
9	24	14500	15373	873	521
10	25	17507	19130	1623	914
11	26	17507	19130	1623	863
12	27	17507	19130	1623	815
13	28	17507	19130	1623	769
14	29	17507	19130	1623	726
15	30	17735	19513	1778	751
16	31	17735	19513	1778	709
17	32	17735	19513	1778	670
18	33	17735	19513	1778	633
19	34	17735	19513	1778	597
20	35	18385	20069	1684	534
21	36	18385	20069	1684	504
22	37	18385	20069	1684	476
23	38	18385	20069	1684	450
24	39	18385	20069	1684	424
25	40	18574	20679	2105	501
26	41	18574	20679	2105	473
27	42	18574	20679	2105	447
28	43	18574	20679	2105	422
29	44	18574	20679	2105	398
30	45	18039	19901	1862	333
31	46	18039	19901	1862	314
32	47	18039	19901	1862	296
33	48	18039	19901	1862	280
34	49	18039	19901	1862	264
35	50	17837	20579	2742	368
36	51	17837	20579	2742	347
37	52	17837	20579	2742	328
38	53	17837	20579	2742	309
39	54	17837	20579	2742	292
40	55	17224	21194	3970	399
41	56	17224	21194	3970	377
42	57	17224	21194	3970	356
43	58	17224	21194	3970	336
44	59	17224	21194	3970	317
45	60	16725	20520	3795	286
46	61	16725	20520	3795	270
47	62	16725	20520	3795	255
48	63	16725	20520	3795	241
49	64	16725	20520	3795	228
	TOTAL	836024	895252	59228	-17172

IRR = 0.0319

APPENDIX 5

Background Data of Gross Domestic Product and Basic Education Costs for Regression Analysis, Alberta 1961 - 1990

YEAR	GDPA86	BCOST
1961	17908.0	522223.0
1962	18903.0	619706.0
1963	20000.0	647902.0
1964	20692.0	633711.0
1965	22163.0	721448.0
1966	23859.0	840616.0
1967	24237.0	911445.0
1968	25380.0	981657.0
1969	26910.0	1086987.0
1970	28276.0	1140511.0
1971	29441.0	1214563.0
1972	31690.0	1289232.0
1973	34905.0	1285941.0
1974	37158.0	1363576.0
1975	38573.0	1486056.0
1976	40119.0	1561607.0
1977	41907.0	1873649.0
1978	44537.0	1621920.0
1979	49345.0	1702295.0
1980	51486.0	1723387.0
1981	55026.0	1887259.0
1982	52350.0	2083670.0
1983	50800.0	2098357.0
1984	53932.0	2167710.0
1985	56156.0	2229372.0
1986	56553.0	2263825.0
1987	57548.0	2201189.0
1988	62350.0	2205017.0
1989	63143.0	2248298.0
1990	63433.0	2244091.0

SOURCES: Alberta Bureau of Statistics.
Statistics Canada, Catalogue 81-220.

NOTES:

1. GDPA86: Gross Domestic Product in millions of dollars.

2. BCOST: Basic education costs in thousands of dollars. Costs includes public schools, private schools and federal schools.